CLAIMS

1. A voltage controlled oscillator with a modulation function, comprising:

a first varactor diode;

a second varactor diode whose anode side is connected to an anode side of the first varactor diode and a ground voltage;

a third varactor diode whose cathode side is connected to a cathode side of the first varactor diode;

a fourth varactor diode whose anode side is connected to an anode side of the third varactor diode and whose cathode side is connected to a cathode side of the second varactor diode;

a first resistor connected between a connection point between the anode sides of the third varactor diode and the fourth varactor diode and a connection point between the anode sides of the first varactor diode and the second varactor diode;

a modulation current terminal for performing frequency modulation that is connected to the anode sides of the third varactor diode and the fourth varactor diode;

a second resistor connected between a connection point between the cathode sides of the first varactor diode and the third varactor diode and a voltage input terminal;

a third resistor connected between a connection point between the cathode sides of the second varactor diode and the fourth varactor diode and the voltage input terminal;

a first capacitor having a first end connected to a connection point between the cathode sides of the first varactor diode and the third varactor diode;

a first inductor having a first end connected to a second end of the first capacitor;

a second capacitor having a first end connected to a connection point between the cathode sides of the second varactor diode and the fourth varactor diode;

a second inductor having a first end connected to a second end of the second capacitor; and

a voltage source connected to second ends of the first inductor and the second inductor,

wherein a wave that is frequency-modulated is output by controlling

a current.

2. The voltage controlled oscillator with a modulation function according to claim 1, wherein an oscillation frequency is shifted by changing a capacitance value of a capacitor including the first capacitor that configures a first LC resonant part in cooperation with the first inductor, and a capacitance value of a capacitor including the second capacitor that configures a second LC resonant part in cooperation with the second inductor, thereby obtaining a plurality of frequency bands.

3. The voltage controlled oscillator with a modulation function according to claim 1, comprising a current control circuit that is provided at the modulation current terminal, and controls a modulation current based on modulation data and frequency data.

4. The voltage controlled oscillator with a modulation function according to claim 2, comprising a current control circuit that is provided at the modulation current terminal, and controls a modulation current based on modulation data and band data.

5. The voltage controlled oscillator with a modulation function according to claim 2, comprising a current control circuit that is provided at the modulation current terminal, and controls a modulation current based on modulation data, frequency data, and band data.

6. The voltage controlled oscillator with a modulation function according to claim 1, comprising:

an arithmetic circuit for receiving modulation data and frequency data, and compensating a modulation current by an arithmetic operation; and

a digital-analog converter for receiving a digital modulation current compensated by the arithmetic circuit, and converting the digital modulation current into an analog modulation current to the modulation current terminal.

7. The voltage controlled oscillator with a modulation function according to claim 6, comprising a filter that is provided between the modulation current

terminal and the digital-analog converter, and eliminates a digital noise of the digital-analog converter.

8. The voltage controlled oscillator with a modulation function according to claim 2, comprising:

an arithmetic circuit for receiving modulation data and band data, and compensating a modulation current by an arithmetic operation; and

a digital-analog converter for receiving a digital modulation current compensated by the arithmetic circuit, and converting the digital modulation current into an analog modulation current to the modulation current terminal.

9. The voltage controlled oscillator with a modulation function according to claim 8, comprising a filter that is provided between the modulation current terminal and the digital-analog converter, and eliminates a digital noise of the digital-analog converter.

10. The voltage controlled oscillator with a modulation function according to claim 2, comprising:

an arithmetic circuit for receiving modulation data, frequency data, and band data, and compensating a modulation current by an arithmetic operation; and

a digital-analog converter for receiving a digital modulation current compensated by the arithmetic circuit, and converting the digital modulation current into an analog modulation current to the modulation current terminal.

11. The voltage controlled oscillator with a modulation function according to claim 10, comprising a filter that is provided between the modulation current terminal and the digital-analog converter, and eliminates a digital noise of the digital-analog converter.

12. The voltage controlled oscillator with a modulation function according to claim 1, comprising:

an arithmetic circuit for receiving modulation data and frequency data, and compensating a modulation current by an arithmetic operation;

a ROM for receiving as an address signal a digital modulation current

compensated by the arithmetic circuit, and outputting a data signal stored in the ROM;

a digital-analog converter for receiving the data signal from the ROM, and converting the data signal into an analog modulation current to the modulation current terminal; and

a filter that is provided between the modulation current terminal and the digital-analog converter, and eliminates a digital noise of the digital-analog converter.

13. The voltage controlled oscillator with a modulation function according to claim 2, comprising:

an arithmetic circuit for receiving modulation data and band data, and compensating a modulation current by an arithmetic operation;

a ROM for receiving as an address signal a digital modulation current compensated by the arithmetic circuit, and outputting a data signal stored in the ROM;

a digital-analog converter for receiving the data signal from the ROM, and converting the data signal into an analog modulation current to the modulation current terminal; and

a filter that is provided between the modulation current terminal and the digital-analog converter, and eliminates a digital noise of the digital-analog converter.

14. The voltage controlled oscillator with a modulation function according to claim 2, comprising:

an arithmetic circuit for receiving modulation data, frequency data, and band data, and compensating a modulation current by an arithmetic operation;

a ROM for receiving as an address signal a digital modulation current compensated by the arithmetic circuit, and outputting a data signal stored in the ROM;

a digital-analog converter for receiving the data signal from the ROM, and converting the data signal into an analog modulation current to the modulation current terminal; and

a filter that is provided between the modulation current terminal and the digital-analog converter, and eliminates a digital noise of the digital-analog converter.

15. The voltage controlled oscillator with a modulation function according to claim 12, wherein the digital-analog converter compensates an output amplitude level based on amplitude compensation data so as to adjust a central value of a modulation factor.

16. The voltage controlled oscillator with a modulation function according to claim 13, wherein the digital-analog converter compensates an output amplitude level based on amplitude compensation data so as to adjust a central value of a modulation factor.

17. The voltage controlled oscillator with a modulation function according to claim 14, wherein the digital-analog converter compensates an output amplitude level based on amplitude compensation data so as to adjust a central value of a modulation factor.

18. A voltage controlled oscillator with a modulation function, comprising:

a first varactor diode;

a second varactor diode whose cathode side is connected to a cathode side of the first varactor diode and a ground voltage;

a third varactor diode whose anode side is connected to an anode side of the first varactor diode;

a fourth varactor diode whose cathode side is connected to a cathode side of the third varactor diode and whose anode side is connected to an anode side of the second varactor diode;

a first resistor connected between a connection point between the cathode sides of the third varactor diode and the fourth varactor diode and a connection point between the cathode sides of the first varactor diode and the second varactor diode;

a modulation current terminal for performing frequency modulation that is connected to the cathode sides of the third varactor diode and the fourth varactor diode;

a second resistor connected between a connection point between the anode sides of the first varactor diode and the third varactor diode and a voltage input terminal;

a third resistor connected between a connection point between the anode sides of the second varactor diode and the fourth varactor diode and

the voltage input terminal;

a first capacitor having a first end connected to a connection point between the anode sides of the first varactor diode and the third varactor diode;

a first inductor having a first end connected to a second end of the first capacitor;

a second capacitor having a first end connected to a connection point between the anode sides of the second varactor diode and the fourth varactor diode;

a second inductor having a first end connected to a second end of the second capacitor; and

a voltage source connected to second ends of the first inductor and the second inductor,

wherein a wave that is frequency-modulated is output by controlling a current.

19. The voltage controlled oscillator with a modulation function according to any one of claims 3, 5 to 7, 10 to 12, 14, 15, and 17, wherein an input voltage from the voltage input terminal is used instead of the frequency data.